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The telecommunications industry in transition : impact of divestiture.

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NAVAL POSTGRADUATE SCHOOL
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THE TELECOMMUNICATIONS INDUSTRY IN TRANSITION:
IMPACT OF DIVESTITURE

by

Dennis Joseph Dezelan

March 1984

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Presented in this thesis is a brief historical review of the telecommunication industry and events leading to deregulation. Management challenges and opportunities are examined on the basis of the changing technology advancing the telecommunications industry. Strategies for telecommunication managers are examined in view of the opportunities and problems encountered.

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The Telecommunications Industry in Transition: Impact of Divestiture

by

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ABSTRACT

On 1 January 1984 the final act of a long anti-trust suit between the Department of Justice and the American Telephone and Telegraph Company unfolded. AT&T divested itself of its twenty-two operating companies and simultaneously shed its long coveted position as a regulated monopoly. Military and civilian telecommunication managers at policy or operational levels must consider telecommunications as an industry in transition and act accordingly to maximize opportunities of competition and minimize the hazards and frustrations of an industry reaching out in all directions at once.

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I. INTRODUCTION

January 1, 1984 is the most significant date, among many recently, for the telecommunications industry in the United States. First it marks the formal divestiture of American Telephone and Telegraph and second it is the day that the job of a telecommunication manager became infinitely more challenging. The task of planning communications, which was done by AT&T and the Bell System, became an internal responsibility. Neglecting the task now means wasting financial resources and ignoring opportunities to raise productivity and cut cost.

It is the purpose of this study to analyze the telecommunications industry and provide the telecommunication manager with an insight into the technology behind the industry, the legislation spawning fierce competition within the industry and strategies for successful management during this period of dynamic transition.

A. THE NEED TO COMMUNICATE

The services provided by communications have long been recognized as a vital resource in the United States. They make possible the smooth functioning of our complex economy. They can assist in promoting international understanding and good will; they constitute an important requirement for our

national security. From the very beginning the life-saving aspects were recognized. The ability to influence, in a positive manner, natural or man made disasters was perceived. The technology provided the means to communicate and society furnished an ever growing list of needs. A relationship was formed between society, which influenced the development and application of communications, and the communication industry which responded with products and services. Therefore the corporate, public and government sectors each have a major interest in assuring the adequacy and efficiency of these services.

Radio, television and telephone service are the products most often identified with the communication industry. Mass marketed, low cost and easily operated, these items have provided a nation with instantaneous communication. They have become important functions of everyday life and may be properly classified as mass communication. The difference between mass communication and telecommunication is based on the contrast in the characteristics of the services provided and the facilities required by those two classes of communication. Telecommunication services enable individuals, or machines appropriately programmed by individuals, to communicate with each other. The individuals furnish and control the content of the messages which are transmitted [Ref. 1: p. 8].

Several key causes can be identified as major forces in the strong development of the communication industry. The advances in communication technology have resulted in an increasing diversity of services being rendered by a variety of transmission modes. The opportunities made possible by new technology have encouraged the formation of communication companies. The communication industry benefits from the rising cost of energy. With each rise in energy cost the industrialized world economy accelerates the shift from heavy industry toward an information driven economy.

In 1973 the oil embargo triggered a rise in the price of oil from $3.00 to $12.00 a barrel. This rise marked the end of cheap energy and the beginning of a serious effort to find a substitute. Pushed by the economic reality that cheap energy is gone the industrialized world is substituting information services for less efficient means. It is this underlying economic urgency to get on with business, and also consume less resources, that is propelling the telecommunications industry to unprecedented heights. Customers are demanding more of their communications systems, because, to be competitive in the world market they have to maximize available assets.

B. BIRTH OF A MONOPOLY

1. The Bell System

The largest communication firm in the United States is American Telephone and Telegraph (AT&T). Prior to divestiture it was organized into 22 operating companies, Western Electric and the Bell Telephone Laboratories. The size of AT&T is in sharp contrast to its humble beginning.

Securing a patent on 14 February 1876, Alexander Graham Bell secured the rights to his idea for a new invention. His efforts succeeded and on 10 March 1876 the first words were spoken over the telephone. In 1877, construction of the first telephone line from Boston to the suburb of Somerville, Massachusetts, was completed. The Bell Telephone Company was established in 1878 and in 1880 it was reorganized into the American Bell Telephone Company. The following decades witnessed the growth and expansion of the network over greater and greater distances.

The primary function of the Bell system is the furnishing of telephone service. Through interconnection agreements with independent companies, it provides domestic and long distance telephone service to the 182 million telephones in the United States, and international telephone service to nearly all the balance of the world's telephones.

After more than a century of business experience AT&T was the premier communication company in the United States. It was also the largest corporation in the world

with assets exceeding one hundred billion, revenues of seventy three billion and an annual net profit of seven billion dollars. AT&T had one million employees, three million shareholders who own the nearly nine hundred million shares of outstanding common stock. AT&T revenues were secured by a ninety seven percent market share of long distance traffic. Every day more than six hundred million conversations were tansmitted over its system. [Ref. 2: p. 750].

2. Challenges to AT&T

There is a common misconception that a well established corporation can successfully support any kind of burden the government chooses to lay on it, the sad histories, of GM, U.S. Steel, and others, not withstanding. Now AT&T, the most solid of them all, is beginning to show the strain. AT&T's problems stem from the government's decision to end its monopoly. A major question concerns the loss of new business and the ability to replace lost revenues. AT&T's competitors now win as much as fifty percent of the orders for new equipment. And in the long distance market the ninety seven percent share could drop to ninety three percent this year, and perhaps eighty four percent by 1985-1987. Will there be a time when AT&T is no longer the dominant carrier? Other unknowns include the action of utility commissions that have the power to regulate profits. If inflation remains low and interest

rates remain level or drift lower the company will be hard pressed to seek rate increases from public utility commissions. Additional sources of revenue from access charges have been delayed because of recent rulings by the Federal communication Commission. Chapter III contains more details on that subject.

AT&T faces internal challenges as well. First, it must develop and market additional innovative products. Second, it must pursue a more aggressive response to products that others introduce. Third, public relations should be emphasized in view of the competitive environment. AT&T has allowed otherwise unparalleled achievements, like the transistor and the dial telephone, to be overshadowed by the accusations of the press, competitors and regulators. The lack of aggressive promotion can be traced to the nature of the industry. An industry where barriers to entry historically have been great. Government policy, capital outlays and technological know-how were difficult obstacles to overcome. Feeling secure on that flank the company chose instead to emphasize other strengths like the size of its networks, reliability, quality of service and efficiency which provide the best telephone service in the world.

3. Competition on the Horizon

The Federal Communication Commission, created by the Communications Act of 1934, is an independent agency

empowered to regulate interstate and foreign commerce in communications by wire and radio. The purpose of the Act is

> "to make available, so far as possible, to all the people of the United States a rapid, efficient, Nation-wide, and world-wide wire and radio communications service with adequate facilities at reasonable charges, for the purpose of promoting safety to life and property through the use of wire and radio communication..." [Ref. 3: p. 192].

The FCC charged with this responsibility has taken actions throughout the last fifty years to further those objectives. Among the most significant rulings issued by the FCC was the 1980 Computer Inquiry II Decision. That decision decreased AT&T's hold on the equipment market and introduced new competition from both domestic and foreign firms.

An anti-trust judgement from 1956 won by the Department of Justice resulted in competitive changes that fundamentally altered the telecommunication industry. In January 1982 in a consent agreement with the Department of Justice, AT&T agreed to divest itself of ownership of its twenty-two operating companies. In exchange the provisions of the 1956 judgement would be vacated, and the Bell system would be permitted to compete fully in computer networks and data tansmission markets plus other non-regulated markets from which it had been excluded. In August of 1982 the court gave final approval to the consent agreement.

Regulatory change, technical advancements and the needs put forth by the marketplace are each contributing to

the upheaval in the telecommunication industry. Competition is filling the opportunities created by deregulation. A plethora of new communications networks, services, and products are coming from U.S. suppliers like General Telephone & Electronics Corporation, MCI Communications, and Rolm. At the same time, long-established foreign manufacturers--Britain's Plessey, West Germany's Siemens, and Japan's NEC, as well as Ericsson--began attacking the wide open U.S. market.

The impact of deregulation has given rise to a competitive horizon full of activity. It is internal, external and bi-directional. The domestic and international telecommunication firms are looking for market share. At the same time Western Electric Co., AT&T's giant manufacturing arm is developing its own export markets. While the U.S. market will be very strong thru this decade Western Electric is going global to meet the world growth in communication.

C. THE INDUSTRY IN TRANSITION

The telecommunication industry traces its roots back more than a century. Those early days can best be characterized as provincial. Each country administered its own telephone and telegraph service. Until the 1940's that administration was centered about local phone service. And

the fortunes of equipment makers depended on their relationship with local telephone companies.

Today in the industrialized nations technology is changing so rapidly that equipment is obsolete almost as soon as it is installed. The momentum of new products, created by technology, in turn creates new demand everywhere for a wider choice of telecommunication services. For the consumer, manufacturer, supplier and regulator many questions need to be answered. What is the scope of the industry? Who are the players? What is the technology driving developments? How is productivity increased? And what is the role of the equipment makers?

The stakes are enormous. The market is worth tens of billions of dollars over the next decade. The risks, innovation, failures and rewards achieved by today's industry players will be tomorrow's textbook examples. There will be winners and losers as the cross currents of the telecommunications industry play out in the coming decade.

1. A Digital Revolution

The most familiar telecommunications system is the public telephone network. The basic building block of this system is the voice channel. Over this channel signals, either analog or digital, are transmitted. A signal is said to be continuous or analog if as it passes through its range of values it can assume all of the values within its

spectrum. A discrete or digital signal can only assume certain specific values within its range [Ref. 4: p. 5]. And it is this digital signaling, the language of computers, that carries data more efficiently than the older analog technology.

Digital central-office switching equipment currently handles numerous functions without operator intervention. Services provided include determining if a called number is busy or if the call can be completed. Digital switching can direct the caller to the appropriate action for example, a busy signal, to an intercept operator, or to a recording. When the call is complete the equipment disconnects and frees up the lines. Automatic billing, alternate phone numbers, routing and switching throughout the system are routinely handled. The rush to digital switching is as much a benefit to established providers as it is a competitive edge to the new market entrant. Firms that convert to digital first can operate like a public highway, carrying any type of information.

2. The Equipment Market

Today every major manufacturer in the industry produces digital switching equipment. In early 1976 Northern Telecom, the largest Canadian manufacturer of telecommunication equipment and computer terminals, began producing a full line of digital telephone equipment. Northern has maintained its lead and is the world leader in

expensive digital central-office switches which are used by telephone companies to direct phone calls. In the United States, along with Rolm and AT&T, Northern is one of the top three vendors of digital private-branch exchanges. They have installed seven million lines and have about six million on order. [Ref. 5: p. 1]

The equipment market for subscribers consists of telephones, private branch exchange systems, telex machines and other equipment to send and receive messages. Internationally countries are building, expanding and modernizing their telecommunications systems and are purchasing equipment ranging from cable and wire to local telephone switches. A summary of the major equipment suppliers and carriers is provided in Table I.

Table I. Key Telecommunication Suppliers and Carriers.

North American suppliers--	AT&T, GTE, Harris, IBM, Mitel, Northern Telecom, Rolm
Japanese suppliers--	Hitachi, NEC, Fijitsu
European suppliers--	CIT, Alcatel, L.M. Ericsson, GEC, Phillips, Plessey, Siemens, Thomson
North American Carriers--	AT&T, ITT, MCI, Western Union International, RCA, TRT, Western Union
Satellite Carriers--	Intelsat, Orion, International Satellite

This year subscriber equipment purchases will exceed nineteen billion dollars and telephone company equipment

purchases will surpass thirty nine billion dollars. Today's competitive climate finds many manufacturers forming international business arrangements. AT&T and Phillips recently formed a new venture to maximize the manufacturing capability of an AT&T and Phillips European distribution system. At the same time, the merging of telecommunication and data processing is prompting similar ventures by such teams as Ericsson/Honeywell and IBM/Rolm.

As barriers continue to fall sales of telecommunication equipment that were not possible several years ago are now occurring. Japan, for example, was a closed market for private branch exchange (PBX) switchboards and other telephone equipment as recently as two years ago. But Japan Air Lines bought three electronic switchboards from Rolm Corporation, a company that has supplied the airline with similar systems in the U.S.. Equipment makers from around the world are focusing their attention on selling equipment directly to users.

Most of the action, however, is in the United States. Since 1968, when the FCC ruled that non-telephone company equipment could be hooked up to the public telephone network, foreign equipment makers have increased their position in the domestic market. Of the $2.8 billion in PBX systems sold in the U.S. this year, Canadian firms will sell 28% and Japan and Europe combined will take an additional 22% of the total [Ref. 6: p. 136]. U.S. equipment makers

are increasing their export position because developing nations are only starting to install telephone systems. U.S. equipment makers to date have not been as successful as the foreign competitors. AT&T for example captures less than 5% of its equipment sales outside the U.S.. L.M. Ericsson on the other hand gets 95% of its sales outside of its own country. [Ref. 6: p. 138]

3. Enhancing Productivity

Telecommunications has become the object of major interest in private, public and government arenas because it is so critical to the world's economy. Investments in telecommunication in Japan, France and the U.S. already represent as much as 9% of their total gross domestic product.

Without a sound telecommunication structure a good business environment is hard to expand or maintain. Lacking modern, flexible and competitively priced communications facilities, a country runs the risk of slowing overall economic development.

The core of the new uses for telecommunications is the technical revolution in the world's networks. The older systems were designed to carry only a single type of information: telephone calls, telegrams, or telex messages. But today's high-capacity digital computers can transmit everything--voice, data or image--in the same way by converting the information into a stream of computer on off

pulses. Having systems work together increases the efficient use of a valuable resource and lowers the unit cost per transmission.

Productivity is enhanced when businesses are able to deliver information quickly to the people who need it. Digital communication and the network technology does this very well. For example, the cost of business travel can be reduced by the use of video teleconferencing. The usually unproductive travel time of executives, engineers and marketing personnel can be eliminated while allowing closer management of distant facilities.

Without the productivity of telecommunication and data processing networks the banking system would experience significant backlogs. American Express approves 250,000 credit card transactions every day from its Phoenix computer center. The capacity and speed of the system has allowed American Express to increase the number of card holders by more than 50% over the last five years. Operating losses have been held to the level of five years ago, thereby lowering the company's operating costs.

Telephone companies in the U.S. and around the world are converting analog systems to obtain the advantages that digital switching provides. Voice, data and video all move over the same system and along with new mediums of transmission, like satellites and optical fiber cables,

these advances dramatically lower the cost of transmitting information.

II. EVOLUTION OF THE TELECOMMUNICATION INDUSTRY

A. THE EXPERIMENTAL YEARS

The invention of the telephone was a logical extension of the state of the art as it existed in the second half of the nineteenth century. If Alexander Graham Bell had not patented the telephone in 1876, someone else would have within a short time. In fact, there was considerable litigation over the true inventor of the telephone before the Supreme Court, in a divided vote, upheld Bell's patent [Ref. 7].

In the United States, the first semiphor was built in 1800 by Jonathon Grout, and in 1835 Samuel Morse, demonstrated the feasibility of an electrical communications system after showing that signals could be transmitted by wire. On January 1, 1845, the first telegraph line from Washington, D.C. to Baltimore was opened.

But there still remained in 1850 one obstacle which could not be solved by the existing means of communications; it was the sea. There were many difficulties involved but still, on 28 August 1850, the first submarine telegraph cable was laid between France and England. The first Atlantic telegraph cable was satisfactorily tested in August 1858.

In 1895 Guglielmo Marconi demonstrated the feasibility of a wireless telegraph. He is generally credited with the explicit implementation that could properly be called radio. His apparatus was actually a wireless telegraph system and did not transmit speech directly.

The approach taken by the early developers was empirical rather than theoretical. Men such as Morse, Bell, Edison, Marconi, DeForrest and others of their era used great ingenuity, perseverance, and often intuitive insight in developing and perfecting their inventions [Ref. 25: p. 16]. The theoretical basis of telecommunications virtually did not exist. While the physical and mathematical laws governing the devices in use were known they had not been organized into a body of knowledge that was useful in explaining their operation or in extending their design to more advanced devices.

Provincial as the telephone companies were, over the years, telephone service has continued to improve as a result of the technological foundations upon which telephony is based. Table II lists important developments in telephony and its subsequent impact on this industry in transition.

B. EARLY COMPETITION AND REGULATION

In the early days of telephony (1873-93) when it held a patent monopoly, the Bell system vigorously opposed any type

of government intervention or regulation. With the expiration of the patent rights, competition entered the market and by 1910 the independent companies had captured a

Table II. Key Developments in Telephony

Date	Development	Impact
1876	Telephone patent (Bell)	Basic concept
1877	Carbon transmitter (Edison)	Great increase in signal level
1878	Telephone exchange	Interconnection of telephones
1889	Step-by-step switching (Strowger)	Automatic telephone switching
1899	Loading coils (Pupin, Campbell)	Made long distance possible
1914*	Vacuum triode (DeForrest, Langmuir)	Amplification of signals
1915	Electric wave filters (Campbell)	Allowed many signals on same wires
1918	Carrier telephony	Practical use of one pair of wires for many signals
1919	Crossbar switch (Palmgren, Betulander)	Improved automatic switching
1921	Submarine cable	Showed feasibility of undersea cable
1936	Coaxial cable transmission	Increased transmission capacity and lower cost
1947	Microwave relay	Reduced cost and increased transmission capacity

1948*	Transistor (Brattain, Bardeen, Shockley)	Miniaturization, reliability and cost reduction
1948	Information theory (Shannon)	Gave precise bounds on attainable per-ormance
1951	Customer direct long distance dialing	Improved service
1956	Transatlantic cable	Reliable overseas telephony
1960	Integrated circuits	Extreme miniaturi-zation and relia-bility
1965	Satellites	Reduced cost and improved service

*Events viewed as technological breakthroughs.

significant share of the market. Competition in some markets drove prices down while in other geographical areas customers paid higher rates for similar service. The stage was set for the first government intervention. In 1910 the U.S. Congress passed legislation which conferred regulatory authority over interstate telephone companies to the Interstate Commerce Commission [Ref. 8]. This was the status quo until 1934 when regulatory responsibility was transferred to the newly formed Federal Communication Commission (FCC). The telephone industry has since operated as a regulated monopoly in which rates and often services are controlled by state and federal agencies.

The Communications Act of 1934 consolidated regulatory authority which was previously delegated to several

agencies. The Radio Act of 1927 created a five man Federal Radio Commission. The FRC commissioners had authority to grant, renew, or revoke stations' licenses. With the creation of the Act of 1934 the FRC was disbanded. The FCC assumed powers over the use of the radio spectrum, by all entities, other than the executive branch.

C. INDUSTRY CONSOLIDATION

The competitive state of the telephone industry at the turn of the century generated aggressive strategies from Bell designed to eliminate weaker independents. Bell countered its competitors by refusing interconnection into its networks, buying out the competitors, and various other anti-competitive tactics. The refusal of Bell to interconnect with other telephone companies led to anti-trust charges and litigation which ended in the Kingsbury Commitment of 1913 [Ref. 7]. The Kingsbury Commitment assured independents of interconnection with the Bell System, and by Federal law they are protected from the threat of being absorbed by the Bell System.

At the time of the Kingsbury Commitment there were in existence some 20,000 independent telephone companies serving about 3.6 million independent telephones [Ref. 1: p. 29]. Today, through mergers and consolidation, 1459 independents remain and they serve 35 million customers. Among the independents, four major companies have emerged:

General Telephone and Electronics Company, United Telecommunication Inc., Continental Telephone Corporation and Centel Corporation. In 1983 these four companies served about 27 million telephones: GT&E about 19 million, United about 4.8, continental about 2.1 million and Centel about 1.1 million telephones [Ref. 2: p. 758].

D. POST WORLD WAR II GROWTH

The continual expansion of telephone service and the theoretical basis on which communications was based occurred in the decades preceding WWII. However it was the urgent need to develop sophisticated radar, sonar and communication equipment that brought the full power of theoretical analysis to bear during the war years. Development programs resulted in the formation of special laboratories and teams of very capable mathematicians, engineers and physicists. Except for the war, many of these individuals would never have been engaged in what has become known as communication engineering.

In 1944 the Mark I computer, the first digital computer, was completed. Two years later the first all electronic computer, ENIAC, was built at the Moore School of Electrical Engineering at the University of Pennsylvania.

In 1948 there was a discovery that would forever alter the communication industry. It was, of course, the

transistor which was invented by Dr. John Bardeen and Dr. Walter H. Brattain, Bell Laboratory employees.

Requiring much less power than the vacuum tube it generated virtually no heat, and was vastly more reliable. It was a startling and profound invention.

Within the decade computers and related equipments were having spectacular effects on communications. In 1950 overseas telephone calls numbered 1.5 million. In 1960 there were 3 million calls and by 1980 nearly 200 million telephone calls were made [Ref. 9: p. 555]. Similar growth occurred in defense communications. AUTOVON, the first switched military telephone network was built by Bell. Today it is the largest private line network in the world. Figure 1 shows the growth of telephone installations in the United States and in the world. However, the number of telephones do not tell the whole story. The new services that are technically feasible and may be introduced in coming years represent an impact at least as great as that of the increasing utilization of existing services.

E. THE BEGINNING OF DEREGULATION

For most of the time since government regulation began, responsible agencies have protected the telephone monopoly. The FCC from its inception through the mid-1960's consistently rejected attempts by potential competitors to enter established telecommunication markets. The only

service in which there was direct competition existed in private leased line service, where AT&T and Western Union

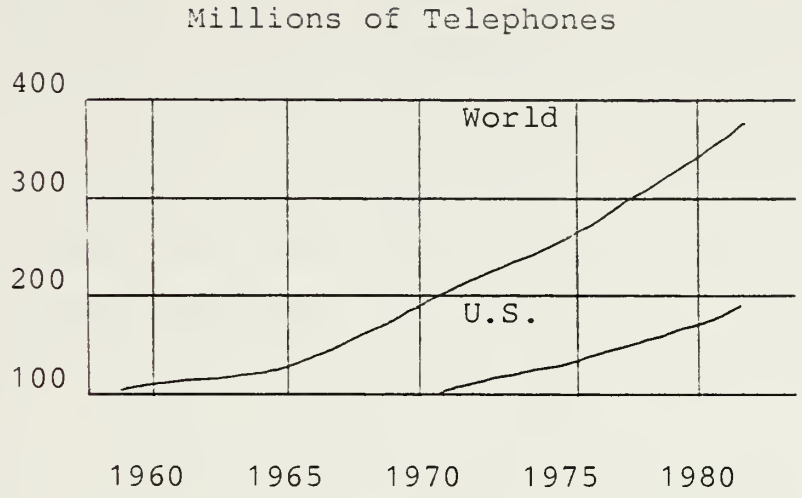

Figure 1. Growth of Installed Telephones
Source: Stat. Abstract of U.S. 1983

offered competing interstate lines for high volume communications users.

AT&T has long been able to prevent the attachment of telephone equipment, not of its own design and manufacture, to its telephone system. Manufacturers were not deterred and many types of devices reached the consumer and business markets. The FCC, through the Hush-a-Phone decision of 1955 upheld Bell's prohibition of foreign attachments [Ref. 10]. Bell claimed it needed to maintain the integrity of the telephone system which it claimed could not be done if non-Bell devices were tied into the system. Further, it argued that they were responsible for the quality of the service to their customers and such quality could not be guaranteed if

devices were permitted on their phone lines. The Federal Court of Appeals reversed the FCC on this decision, in 1956, and that resulted in the first crack in the otherwise complete prohibition against such foreign attachments.

The second major effort to achieve interconnection for foreign attachments was successful. In 1968, in the Carterfone decision, the FCC held that the Bell system had to allow interconnection, as long as the integrity and quality of the operating system was maintained [Ref. 11].

The success of Carterfone opened the market for equipment manufacturers. Products introduced included recording-answering machines, burglar alarms, local switching and intercom systems and many other specialized items. Bell in turn receives a license fee paid by the equipment manufacturer.

The telephone company is a common carrier, which means that it provides service to all users, on request, at a regulated price. Entrants wishing to provide specialized carrier service began appearing in the late 1950's. An issue developed between AT&T and the special carriers concerning whether adequate frequencies were available to accommodate these special requests or whether only AT&T should be allowed to operate in the microwave frequency range. In 1959, the FCC ruled against AT&T in its Above 890 decision. The FCC held that the frequencies available above 890 MHz were large enough and technically open enough for

use by other carriers using microwave links [Ref. 12: p. 81]. This was a first step through the door for other potential carriers. At the outset there were no applicants to use the spectrum above 890 MHz.

MCI was the first special carrier to apply for an FCC license in the above 890 MHz portion of the spectrum. In a 1968 decision MCI's license request was approved. The major attraction of the MCI proposal was that the cost of the service was much lower than that of AT&T. MCI's service was designed for small users who needed the communication link only occasionally or for short periods of time. MCI sought to reach a market ignored or previously not recognized by AT&T.

AT&T opposed the license request on several points. First, that a new service was not being provided. Second, that it would be a non-optimal use of the frequency spectrum and that MCI was not financially responsible enough. The FCC felt that the proposed service was indeed different from that provided by AT&T because it reached a market which the common carrier had not recognized earlier and which it was not serving when MCI made its proposal. During the year after the MCI decision, proponents made 37 applications, involving more that 1700 microwave stations. One third as many stations as the entire Bell system had. [Ref. 13]

F. THE PRESENT ENVIRONMENT

The most significant factor impacting the present telecommunication environment is the structured change brought about by a consent agreement between AT&T and the Department of Justice (DOJ) reached in January 1982 and ratified in August 1982.

The Department of Justice originally filed papers in 1949 charging Western Electric, the manufacturing arm of the Bell system, and AT&T with a conspiracy to restrain trade, and charged Western Electric with monopolizing the market for telephones and related equipment. In a 1956 consent agreement with the DOJ, AT&T and Western Electric agreed to restrict their activities to the regulated telecommunications market. The DOJ in return would drop the anti-trust suit.

The 1982 consent agreement modifies the earlier agreement in the following ways. First, AT&T must divest itself of the twenty two operating companies it then owned. Second, the newly formed Bell operating companies must price their services fairly, so neither AT&T nor its competitors engaged in the information service or equipment markets, would gain an unfair advantage. Third, the Bell system will be allowed to compete in the new computer network and data transmission markets and in all other non-regulated markets from which it had been excluded. Fourth, the DOJ would drop its anti-trust suit against AT&T.

The Supreme Court affirmed, on February 28, 1983, the final agreement prepared by District of Columbia Circuit Judge Harold Green. The result will be a separation of local service, provided by the Bell Operating Companies (BOC's), from interstate service, provided by AT&T and other long distance carriers. AT&T will retain ownership of Western Electric, Bell Laboratories, American Bell, AT&T Long Lines Department and those portions of the telephone subsidiaries which provide interexchange service and customer premises equipment (CPE). The operating companies to be divested would become subsidiaries of seven regional holding companies, the stock of which would be distributed to AT&T shareholders.

III. IMPACT OF DEREGULATION AND DIVESTITURE

A. AN INDUSTRY BOOMS

There are many factors spurring demand for advanced telecommunications equipment. First, the FCC has changed its regulatory position with respect to competition within the telecommunication industry. The most vivid example of this is the recent divestiture of AT&T. Second, the recession of 1982 is now history. A strong and sustained economic recovery is underway. Third, the advancing state of technology offers new and better ways to communicate. Fourth, the rising cost of energy makes the increased use of communication equipment and service an attractive alternative. Finally, competition is resulting in the rapid growth of independent equipment companies. These companies operate in fairly well defined niche markets and respond quickly to satisfy user needs.

The telephone system is also undergoing change. Only a few years ago telephone companies provided plain old telephone service (POTS). Today the telephone network, using the same instrument, has emerged as an integrated information carrying system providing emerging opportunities for new communications services and products.

Changes in telephone systems are occurring in both public (common carrier) networks, such as AT&T, and in

private systems. The changes are designed to upgrade the present telephone system. During the next decade application of relatively new technologies, such as fiberoptics, microwave, and satellite systems should allow the common carrier network to evolve into an integrated service network that will efficiently and economically carry voice, data, facsimile and control information.

The makers of specialized communications systems will benefit from the continued growth in switching equipment. The emergence of specialized carrier networks such as Western Union's Mailgram Service or MCI's Execunet, are now in operation and these firms and others will increase their customer base. The Source Telecomputing Corporation, a subsidiary of The Reader's Digest, Inc., provides 800 information services to 30,000 customers over its commercial network. Although local telephone companies are providing integrated services they will not be able to provide all of their customer communications needs through the primary telephone network. So it is likely that enhanced service networks will continue to thrive.

Economies of scale are complimented by the technology which permits the handling of high volumes of data transmission. Packet switching and digital termination services are two main types of networks used. Packet switching bunches messages from a number of sources into groups that are sent in bursts. GTE's Telenet and AT&T's

AIS/Net 1000 are two current users of packet switching technology. The systems also provide software, which allows computers made by different firms to communicate with each other. Equipment on the receiving end provides high speed local distribution of information from packet-switching networks.

Individual companies with private voice and data networks are deriving benefits, in terms of cost and competitive advantage, from the integrated data network technology. The makers of these private branch exchange (PBX) switches are moving into another area previously handled by the Bell System. The equipment makers are planning, designing, manufacturing, installing and selling integrated switching systems to cost conscious, competitive minded companies. In the U.S. the desire to automate office functions will translate into three billion dollars in PBX sales in 1984 and the expected rise by 1990 will near ten billion.

PBXs are purchased or leased by subscribers for use on their own premises. The basic function of a PBX is to act as a switch that routes telephone calls. Advanced PBXs do much more. They can switch computer data, telex messages, and even facsimile images as easily as voice conversations. The PBX has developed into a communications controller and is the logical focal point for any office system. A typical office automation system consists of a smart terminal--

computers programmed to perform data or word processing--and remote terminals, which are wired to form a local area network (LAN). PBX's serve as a switching window through which machines in one office may be connected to telephone lines to access computers at other sites. The importance of a modern PBX, is its ability to function as a central switch controlling integrated voice and data.

Underlying the new uses for PBX equipment is the change from analog to digital technology. Older PBX equipment with analog technology was designed to carry only a single type of information, the telephone conversation. Analog technology was adequate for voice messages but was unsatisfactory for computers and data. Digital technology converts signals into a stream of discrete on-off pulses. Modern PBXs use digital technology, the language of computers, to pass everything--voice, data, or image--more efficiently than the older analog technology.

The upgrading of local telephone systems to digital switching and the automation of offices with digital PBX's compliment each other. The increasing effectiveness of PBX's and the ease of interfacing with primary carriers will spur growth. That growth will come from the sale of new equipment to first time buyers and from the replacement market as current limited functioning analog PBX's are upgraded. In the U.S. there are approximately 235,000 analog PBX's in use. They are being replaced at the rate of

19,000 per year and by 1990 that will increase to 51,000 annually. 9000 new installations this year will increase to 16,000 annually by 1990. [Ref. 14: p. T2]

In spite of the bright outlook in the booming telecommunication market a shake out in the industry is possible. Profit margins are declining because of lower than expected shipments in 1982, increasing competition and large research and development expenditures. New entrants continue to be attracted to the industry and the keen competition has resulted in the introduction of increasingly sophisticated systems. MITEL's introduction of its SX-2000 digital PBX has been delayed for more than a year by software problems. And AT&T, experiencing a declining market share, is introducing a digital PBX with six advanced capabilities. Table III identifies the PBX market share of the major manufacturers. Indeed, a number of major companies, including Rockwell International, General Dynamics and Datapoint, dropped out of the business within the last year [Ref. 14: p. T3].

The sale of home telephones has increased as a result of deregulation. With 180 million telephones in the United States, the sale of new telephones is about one million annually. As the consumer becomes more aware of the right to buy a telephone demand is expected to surge. A study by International Telephone and Telegraph at the end of 1979 showed that 8% of consumers knew they had this right; two

Table III. United States PBX Market Share

	1980	1985
AT&T	76.4%	49%
Rolm	6.3%	9%
Northern Telecom	5.9%	11%
GTE	2.6%	7%
DTS/HARRIS	2.1%	6%
MITEL	1.7%	9%
Foreign	----	2%
Others	5.0%	7%
Total Lines	22.8 million	40 million

Source: [Ref. 14: p. T28].

years later, another study showed that 60% knew. Marketers are reaching out and creating a demand by improving designs, and offering more features at competitive prices.

B. THE ACCESS CHARGE

In order to keep local rates low AT&T has subsidized local operating companies from revenues generated by the long lines division. With divestiture state utility commissions will regulate intrastate long distance rates. Subsidies from AT&T long lines division will be replaced by access charges billed to the users. Access charges are the fee that the Federal Communication Commission wants people, businesses and long-distance companies to pay for access between local phone systems and long-distance lines.

AT&T has been counting on the implementation of access charges to offset declining profit margins, increase quarterly earnings (an important consideration for a

publicly traded company) and to increase market share by reducing long distance rates by an estimated ten percent. The proposed access charge for residential users is $2 per month. Anyone making $20 a month of interstate long distance calls would break even. The $2 reduction will offset the $2 access fee.

The FCC approved the access charge and it was scheduled to go into effect 3 April 1984. However it has become such an intense source of debate and confusion among regulators, users, investors and politicians that the implementation of the access charge is unclear. Congress has become involved. Bills have been introduced to limit the fee. Those who stand to lose the most, competitors of AT&T and users are opposed to the access charge. AT&T has lobbied vigorously for the access charge and has placed full page adds in the Wall Street Journal and other publications explaining the company's position.

Access charges have been permitted by the FCC as a mechanism for shifting the cost of local service to the users. For years this cost was hidden in long distance bills. In order to equalize the competitive advantage between low cost long distance carriers who do not also support local telephone companies, the FCC chose this method of shifting the cost.

If the access charge is enacted two significant advantages to the Bell System would be in place. First, the

cost of doing business for the low cost long distance carriers, like MCI and SPRINT, will increase thereby narrowing their current rate advantage. Second, large businesses who are considering switching to a low cost carrier to avoid AT&T's higher rates, would lose the economic incentive to do so.

The amount of the access charge would vary for residential, business customers, and for long distance companies. Under the FCC plan the residential subscriber access charge would be $2 per month per line and as much as $6 a month for businesses. The access charge would be imposed even if no long distance calls were made. An increase to $4 per month for residential users is estimated by 1990. The FCC plans to increase access charges over a number of years to ease the financial burden on the public.

A bill approved by the House Commerce Committee would ban access charges for residences and businesses that have only one phone line and it would freeze the access charge paid by AT&T's long distance competitors at August 1983 levels. A bill introduced in the Senate would delay the residential access charge for two years [Ref. 15].

C. POST BELL BREAKUP

On 16 November 1983 AT&T filed a 267 page document with the Security and Exchange Commission describing it's proposal for splitting up the $152 billion in assets among

the eight companies resulting from the divestiture on 1 January 1984. Prior to divestiture AT&T had been the world's largest corporation based on assets. It now ranks fourth among U.S. industrial corporations behind Exxon, General Motors Corporation and Mobil Corporation.

For 1984 the eight companies estimate total revenues of $116 billion and a net profit of $8.7 billion. AT&T's portion of the net profit is estimated at $2.1 billion and the combined profit of the seven regionals is $6.59 billion. [Ref. 16: p. 22]

AT&T will lose the right to use the Bell name. It will, instead, be known as AT&T while the operating companies will be given the exclusive use of the name Bell. In addition, the yellow pages, previously published by AT&T will in the future be published by the operating companies. Figure 2 depicts the pre-divestiture organization chart and Figure 3 depicts the post-divestiture organization chart. Under the divestiture plan, the 22 operating companies will become subsidiaries of the holding companies listed below.

(1) NYNEX Corporation
    a. New York Telephone Co.
    b. New England Telephone and Telegraph Co.

(2) Bell Atlantic
    a. New Jersey Bell Telephone Co.
    b. The Bell Telephone Co. of Pennsylvania
    c. The Diamond State Telephone Co.
    d. The Chesapeake and Potomac Telephone Co.
    e. The C&P Telephone Co. of Maryland
    f. The C&P Telephone Co. of Virginia
    g. The C&P Telephone Co. of West Virginia

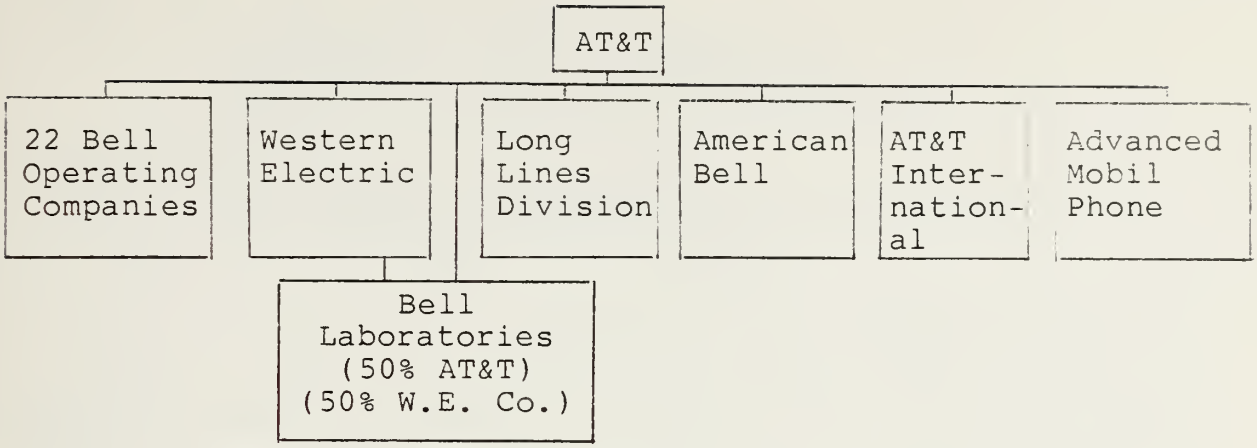

Figure 2. Pre-Divestiture Organization

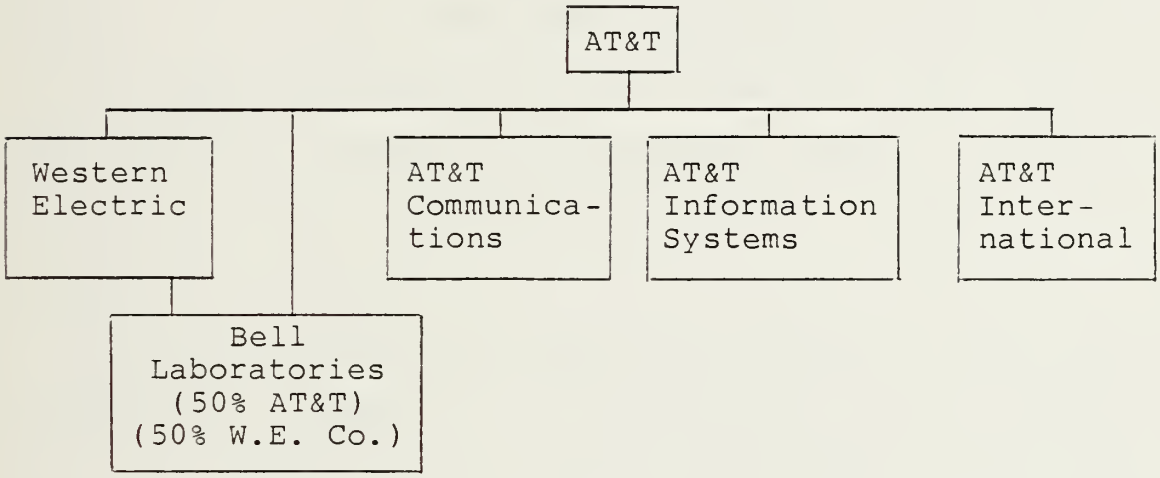

Figure 3. Post-Divestiture Organization.

(3) Bell South Corporation
    a. South Central Bell Telephone Co.
    b. Southern Bell Telephone and Telegraph Co.

(4) American Information Technologies Corp. (AMERITECH)
    a. Illinois Bell Telephone Co.
    b. Indiana Bell Telephone Co.
    c. Michigan Bell Telephone Co.
    d. The Ohio Bell Telephone Co.
    e. Wisconsin Telephone Co.

(5) Southwest Bell Corporation
    a. Southwestern Bell Telephone Co.

(6) U.S. West, Incorporated
    a. Northwestern Bell Telephone Co.
    b. The Mountain States Telephone and Telegraph Co.
    c. Pacific Northwest Bell Telephone Co.

(7) Pacific Telesis Corporation
    a. The Pacific Telephone and Telegraph Co.
    b. Bell Telephone Co. of Nevada

As a result of divestiture the regional operating companies are now free to diversify into some unregulated areas. Some regionals are setting up subsidiaries to conduct business such as Yellow Pages publishing, equipment sales and cellular phone service. Cellular phone service is a car telephone system that has a greater useful range than the previous mobile car telephone system. However the majority of the operating revenues will come from the telephone business.

The Bell operating companies possess a wide range of attributes. NYNEX is in an area where service industries are concentrated, but, it has a less modern phone network and fewer digital switches than most of the Bell system. Fiber-optic networks are distributed only around Manhattan and Boston. Bell Atlantic plans to concentrate on equipment sales. It was one of the first to select equipment vendors other than AT&T when it chose to sell products of TIE communications and NEC Corporation. Additionally, Bell Atlantic has formed a subsidiary called Bell Atlantic Management Services Inc. under which many functions

including billing, purchasing and regulatory planning will be centralized.

Bell South Corporation will be the largest regional company in terms of assets, totaling $21.5 billion. Rate increases granted by utility commissions permit Bell South Corporation to earn the highest rate of return on equity of all the regional companies.

AMERITECH is the first regional to start a cellular mobile phone service. The Chicago area operation has twice as many car-phone customers as it first projected.

Southwest Bell Corporation has led the Bell system in Yellow page revenues due to the many new businesses in its geographical area. It also leads the system in the number of electronic switching systems. About 70% of its lines have electronic switching while the Bell system average is 55%.

U.S. West, Incorporated encompasses 14 states and is the largest regional geographically. It has set up a unique subsidiary, Interline Communications Services, Inc., to provide communications consulting, engineering, installation and maintenance.

Pacific Telesis Corporation faces the largest threat from bypass. Bypass is where large communication users set up their own communications networks. Already there are 4300 private microwave transmission channels in California. On the residential front, however, California looks good.

One in every 10 homes has a personal computer, twice the national average. Most of the home computers transmit and receive data over phone lines. [Ref. 17]

D. REGULATORY SECOND THOUGHTS

On 19 January 1984 the FCC issued a ruling which delays the imposition of long distance access charges for some customers. As a result of this latest decision residential and small business customers will not see access charges on their telephone bill until June 1985. The flat monthly charges are still set to begin for most business customers on 3 April 1984.

The FCC also ruled that the $2 dollar per month fee for residential and small business customers should be increased gradually until 1990 but should not go higher than $4 dollars per month.

On a related matter the FCC decided that AT&T competitors for long distance service such as SPRINT and MCI should be limited to paying 45% of what AT&T pays for its connection to local telephone lines. The FCC permits differences in connect charges in order to attract new entrants to the long distance communications market and to offset the quality of service advantage which AT&T currently has. That limit would remain in effect until current differences in long distance service are eliminated. Because the long distance access charges are intended to

replace AT&T subsidies to local telephone companies, AT&T vigorously opposed the FCC ruling. The FCC ruling was enacted at the urging of Congress which is under pressure from constituents concerned about escalating rates for telephone service. As a further consequence of the FCC decision to delay the imposition of access charges, the status of AT&T's planned 10% reduction in long distance rates is uncertain [Ref. 26].

The impact of FCC decisions also affects telecommunication managers. Decisions to replace, upgrade, lease or buy telecommunication systems are based on the needs of the company and the economic justification compiled for long term high value investments in the equipment, personnel and training. When plans for telecommunication systems are converted to actions the costs to terminate a project or pay for conversion to an alternate system are substantial. For example, the access charge to take effect on 3 April would cost large businesses and the government $6 per telephone plus $25 per line for big users such as Department of Defense (DOD). These fees would add an estimated $25.2 million to the telephone bills for the Defense Communication Agency Autovon Interswitch Trunk and the Defense Washington Telephone system for fiscal year 1984. Currently DOD pays more than $800 million a year for long haul communications for the military departments and the Federal Aviation Administration. [Ref. 18: p. 28]

As a means of reducing communication costs the increased use of satellites is being considered. If a satellite option is selected by DOD the resources committed to the project would be unnecessary if a similar FCC decision froze or eliminated access charges for large users.

E. PRODUCT PROLIFERATION

The telecommunication industry is attracting new competitors. Hundreds of firms both foreign and domestic are bringing to market telecommunication products and pursuing niche markets in an effort to gain a competitive advantage. While the market is certainly made up of equipment manufacturers and telephone companies a large number of telecommunication consulting services are emerging. These firms provide management services such as billing, planning, design, installation and maintenance.

The growth of commercial management firms for telecommunication services is without precedent and its formation is the direct result of deregulation and divestiture. Some firms in this business include AT&T Information Systems, AT&T Communications, GTE Services, American Satellite, Western Union and International Telephone and Telegraph. The Defense Communication Agency, for example, has six firms under consideration to manage its long haul system for the military (so that problems can be

avoided and corrected with the minimum of disruption.) [Ref. 18: p. 28]

The market for residential telephones has attracted many firms. Although most of the Bell Operating Companies are expected to stop selling ordinary home telephones, other competing firms are filling this gap. AT&T under the divestiture plan will own the home telephones most users lease. AT&T plans to sell these phones to current users at discounted prices and this has led to slimmer profit margins for its competitors and subsequently lower prices for telephones to consumers.

The repair of telephones, and even the diagnostic equipment to determine whether the problem is in the instrument or in the line, is creating other opportunities. If the telephone is leased from AT&T and it breaks, the responsibility to repair the telephone is AT&T's. If the problem is in the line the local operating company is responsible for repair. Determining where the initial problem is may not be simple. For example, the Fidelity Group, a Boston money management firm got caught in the middle of a dispute over whether its problem was equipment or line, so the repairs were not done for three days. Fidelity is spending $25,000 on diagnostic equipment so it can quickly figure out if it has an equipment or line problem [Ref. 19: p. 29]. If the telephone is owned by the

individual user the responsibility for repairing the telephone is the users.

Specialized Common Carriers such as MCI and SPRINT have always focused their efforts at the business communication user. But with deregulation and excess capacity during non-business hours they have devised enhanced services networks for a growing market of residential users with home computers. These services are available to anyone with access to a telephone and the appropriate equipment. Computerized on-line data bases, for example, can be accessed through existing telephone lines and information retrieved can be displayed on computer terminals or television screens.

Video teleconferencing, a two way audio/visual communication service using satellites and earth facilities are now being offered by AT&T. This service permits group conferences in which participants are at different locations. With the cost of travel rising this service has the potential to modify traditional communication methods such as face-to-face meetings.

The proliferation of electronic banking and credit card transactions for goods and services, such as gasoline, are examples of practical applications for telecommunications. With hundreds of firms drawn to the industry because of deregulation and divestiture it is certain that many more

known, developing and yet to be discovered applications will be brought to the market place in the coming decade.

IV. TELECOMMUNICATION DEVELOPMENTS

On 1 January 1984 the demand for good telecommunication managers went up. After that date the local telephone company will provide a pair of telephone wires and a dial tone and it will be up to the user to determine services and equipment. A simple enough task if the user is a home owner with two telephones. However, for the manager of a system containing thousands of telephones, the need for real knowledge of communications is vital. In the past telecommunication managers mostly checked phone bills and ordered whatever the Bell salesman recommended. Planning was left to the telephone company. With the advent of deregulation and divestiture it is necessary to have specific information on services and equipment available from Bell and non-Bell sources.

Companies that are confronted with significant telecommunication decisions on equipment and service have several alternatives to choose from. When a need exists, some companies contract for telecommunication consultants. Other companies, that in the past relied on the phone company, are now hiring their own telecommunication managers. Telecommunication management positions, that existed prior to deregulation are being modified to reflect the additional requirements and responsibilities of the job.

Equipment and service developments can be grouped into several broad industry boundaries. The telecommunication manager will be involved with each of these areas. They include telephone enhancements, networking, video communication and satellite communication. In the following sections each of these areas are examined. In addition, Appendix A contains an expanded list of telecommunication developments and uses.

A. TELEPHONE ENHANCEMENTS

The equipment that connects a telephone wire on the customer's premises is called terminal equipment. The ordinary telephone is the most common kind of terminal equipment. Key telephone sets (KTS), private branch exchange (PBX) and modems are also common varieties of terminal equipment. KTS are used by businesses with a small number of telephone lines and several telephone sets. Each line is connected to each set and the user selects a line by pushing the appropriate key. A PBX is used by larger businesses with a substantial number of lines and many telephone sets. The lines from the telephone company do not connect with each set but end at a customer switching center, the switching center is connected with each telephone set and connects the set to the appropriate outside line when the set is being used. A modem (modulator-demodulator) connects a telephone line to a

computer or computer terminal. The modem translates signals from analog mode (used in telephone lines) to digital mode (used in computers). [Ref. 20: p. 234]

The domestic carriers provide two broad types of services to these instruments. The first, message telephone service, consists of the familiar dial-up service provided on a local basis, long distance or toll basis. The second consists of leased circuits provided to subscribers on a private or exclusive use basis. These circuits can be used for voice, data, facsimile or video signals. However, of the two types of service, message telephone service is the major type in use today.

The following is a list of developments that have enhanced telephone capabilities, reduced cost or increased telephone channel capacity.

1. The Helical Waveguide

A pipe, designed to carry 250,000 simultaneous telephone calls or equivalent information, in digital form, over long distances.

2. Cellular Car Telephone

An improvement on car telephones which have been available for years. The old car telephone transmission system operated with a single transmitter per city. Under the cellular system, the telephone company passes the call from one low power transmitter to another as a car passes through a city's zones, or cells.

Chicago was the first city to get cellular phone service. In 1984 the service will be extended to 30 cities in the United States. Ameritech estimates the U.S. market for cellular telephones at 100,000 customers. However with a current cost of $2700 per unit and usage fees of $150 per month the market may not reach its full potential for some time [Ref. 21: p. 13].

3. Fiber Optics

A thin flexible fiber made of extremely pure glass which can carry messages in the form of a light wave rather than as electric current through copper wires. At year end 1982, there were more than 70 fiber optic (FO) systems carrying telephone messages. The market for FO is growing both in total spending and installations. The rapid growth in FO is driven by technological advances and economies of scale. From 1978 through 1983 FO cable cost decreased 85% while the speed at which the system can operate increased 900% [Ref. 14: p. T4].

The most popular use for FO currently is in short haul trunk lines. Possessing a number of attributes such as high capacity, low signal loss, small diameter, light weight, low maintenance costs, and long cable spans when compared with cable between repeaters, they are suitable for a large number of applications.

Notable installations include two 40,000 voice circuit FO systems between New York and Washington, D.C..

AT&T built one and MCI constructed the other. AT&T will install the first transatlantic FO system to be named TAT-8. This system will carry 40,000 voice circuits more than four times the capacity of AT&T's TAT-7, a transatlantic coaxial cable system put into operation during 1983.

The present technology road block to even greater channel capacity in FO systems is the development of a suitable traveling wave amplifier. Current amplifiers are bandwidth limited and therefore the capacity is also limited. Extensive research is ongoing, in optical amplifiers, GTE and Nippon Telephone & Telegraph are leaders in this research effort.

4. Large Scale Integration

This is an ultraminiature device composed of a logic subsystem containing a large number of transistors assembled on a single integrated circuit chip. They are useful in electronic switching because of their small size, high reliability and fast logic circuitry.

5. Electronic Switching Systems (ESS)

ESS developed by Bell Laboratories provides faster call processing, increased reliability and reduced cost to users. As of 31 December 1982 there were 84 ESS in service; these are associated with 2.7 million Bell system toll trunk terminations.

6. Pulse Code Modulation

Pulse code modulation ia a technique for changing a signal from analog to digital. It is used extensively in the Bell system because digital signals can be manipulated with very little distortion.

7. Teleconferencing

Teleconferencing is a service that permits widely dispersed users to exchange information in real time by providing a common circuit linking the telephones between users. The use of teleconferencing is growing because of the advantages it offers. It saves the time and travel cost of conventional face-to-face meetings.

8. Enhanced PBX Systems

By incorporating an endless variety of options the PBX can perform extended functions. For example AT&T's Dimension PBX system provides digital transmission, stored program control, call forwarding and electronic switching. The stored program control is a software feature that permits the user to program predialed numbers, available by pressing only one or two numbers on the telephone, voice activated dialing, incoming and outgoing message recording and remote retrieval.

B. NETWORKING

Networking is a private line service offered by specialized common carriers and telephone companies, to

users who want to interconnect a series of locations by a communication channel. These channels are normally confined to the use of one customer, while a switched network is a network of lines normally used for dialed calls. For example, Atlantic Richfield Corporation installed a $17 million video teleconferencing network that will connect its Los Angeles headquarters with offices in Philadelphia, Denver, Houston, Dallas, and Washington, D.C. [Ref. 6: p. 131]. The capability allows executives to speak and watch one another on a network linkup without leaving their office buildings.

In addition to the network transmission of voice and video, the transmission of data on computer networks is a major application of telecommunications.

A computer network may consist of a number of terminals connected to one or more computers. The major components in a network are terminals, nodes, transmission links and a host. The terminal is the device that interfaces a user to a computer or a computer network. Nodes are computers whose main function is to switch data. Transmission links, such as dial up access lines, microwave or satellite links, provide a common connection of the subnet elements to form a network. A host is a computer used primarily for functions separate from that of switching data.

The development of reliable, low cost networks and affordable terminals have made possible the sharing of

computer power by a large number of users. The early networks were little more than a central computer, serving both as a host and a switch, with a small number of terminals connected to the computer. But improvements in the communication medium, deregulation of the telecommunication industry and a need for efficient information flow have had a combined effect on the growth of computer networks.

Network users can be categorized based on their computer network applications. The three broad categories that constitute the majority of functions for which computer networks have been designed are first, the remote user access, second, the computer-to-computer access and finally message traffic [Ref. 4: p. 206].

1. Remote User Access

A remote user has the capability to access a computer system by connecting to a terminal located at an installation physically distant from the location of the computer. Connection between the terminal and the computer is made through some communication medium.

The user may interact with the computer for processing power or for access to data files stored at the host facility. The response time for an interactive user is generally not more than a few seconds from inputting an inquiry. If processing power is required the response time

may be slower depending on the amount of processing required and the availability of the central processing unit.

2. Computer-to-Computer Access

Users with needs to transport large amounts of data, for example, between corporate headquarters and numerous branch offices, often do so without manual intervention. Computers communicating with other computers make possible such an application.

3. Message Traffic

Message traffic consists of computer users sending messages to other users on the network. The message may be sent to one or more users by invoking addressing routines. It is also possible to have computer generated message traffic. A pre-programmed set of instructions implemented by a computer and transmitted to network terminals or terminal equipment is considered message traffic. Such computer generated message traffic could be for human use or may be for control of hardware components such as security systems, lighting or environmental settings in large office buildings.

C. VIDEO COMMUNICATION

The telephone companies' ability to provide new and innovative services may become an increasingly important source of revenues. POTS, or plain old telephone service is gone and replacing it is an integrated system which uses the

existing network. Computerized on line data bases, for example, can be accessed through existing telephone lines and the information retrieved can be displayed on computer terminals or television screens.

1. Picturephone Meeting Service

AT&T is now offering a video teleconferencing service called Picturephone Meeting Service. This is an all digital, two-way audio/visual communication service using satellites and earth stations which permits group conferencing by participants located in different cities. AT&T made the service available in 12 cities in 1982 and planned to add 42 more cities in 1983 [Ref. 14: p. T23].

2. Videotex

Videotex is delivered by a standard telephone line. It establishes a two way link between the viewer and the data base being accessed. This two way capability permits an array of transactions between the viewer and the data base.

Videotex may be the next telecommunication market to make a significant impact on the way the average person conducts routine transactions. The cost to use this system is low and videotex can be made available on any home television set by some relatively inexpensive modifications. While the early forms of information retrieval provided text only, true videotex offers graphics.

3. Teletext

Teletext is also an information retrieval system. It is delivered over the airways and retrieved on the television by means of a broadcast signal decoder. Currently decoders cost between $75 and $150. The viewer uses a keypad device to chose from the continual stream of pages broadcast. Teletext is not interactive. The viewer cannot control or act on the information in any way, other than selecting the information to be viewed.

4. Cable TV

A method of program distribution in which a cable into homes carries the electronic signal. It is primarily used for the distribution of television programs however, cable capacity is more than one thousand times that of the telephone cable so much of its potential remains untapped.

D. SATELLITE COMMUNICATION

The emergence of satellites as a cost effective method of transmitting communications was a major technological development that sent shock waves through AT&T. Not having patent protection AT&T relied on regulatory protection to prevent competition from entering the carrier market. However when regulatory barriers were removed the potential competition became actual competition. Satellites broke down the right-of-way advantages of the Bell system. With a single satellite, communications could be established

anywhere in the United States. There was no need to establish a vast network of wires or even a network of microwave stations to provide wide coverage.

The first satellite transmission service, inaugurated in 1965 using INTELSAT I, carried one transponder with 240 voice circuits with single access by only two earth stations. Transponders are the device that receives and retransmits the microwave message from earth station to the dish on the ground. Subsequently, INTELSAT II in 1966 had 240 voice circuits and access by several earth stations and INTELSAT III in 1968 provided 1200 voice circuits and multiple access earth stations. Each of these satellites carried two transponders, using one as a spare.

INTELSAT IV launched in 1970 carried 12 transponders, each providing 300 voice circuits, while INTELSAT IVA launched in 1975 carried 20 transponders, each providing 300 voice circuits. [Ref. 4: p. 134]

These first satellites were sponsored by a consortium of nations whose purpose was not domestic competition for the Bell system but rather for the development of international communications.

The first domestic satellites were not far behind. On 9 November 1972 Canada's ANIK-1 was launched, beginning domestic satellite operations in North America. In 1974 Western Union placed two WESTAR satellites in orbit. These

satellites are capable of providing 7000 voice channels or 12 color television channels.

There are currently 14 domestic satellites in space with about 200 transponders. Currently the work load handled by domestic satellites is 32% for video, 3% for data, 35% for voice and a 30% backup. Of the 14 communication satellites now in space, Communication Satellite Corporation, RCA and Western Union each own four, and Satellite Business Systems owns the remaining two. [Ref. 14: p. T23]

Technology and channel capacity are combining to reduce the cost of satellites and at the same time making satellite links cheaper and more competitive over other communication technology.

1. Demand-Assigned Multiple-Access Equipment

A method of sharing available satellite or high-capacity channels among a number of geographically separated users. The signals are crowded together in a manner that allocates portions of channel capacity to users according to their instantaneous needs.

Other satellite improvements include focused transmissions which permit the use of smaller, less expensive, receiving antennas. Improvements in the types of transistors placed on satellite transponders have increased the reliability of satellite communication. At the same time the cost of earth stations, which comprise a large portion of the overall cost of domestic satellite systems,

are diminishing as satellites move to higher operating frequencies where transmissions can be handled by smaller antennas.

Until 1980, all commercial communication satellites operating over North America used the c-band (6/4 GHz). With the increasing traffic, the higher frequency KU-band (14/12 GHz) came into use. As demand is expected to outstrip capacity, it will be necessary to develop satellites that can operate at even higher frequencies, in particular, the Ka-band (30/20 GHz).

Program distribution to cable television systems has fueled much of the growth in satellite systems. In 1983, however, shipments of earth stations to cable television operators appeared to peak. Overall demand for satellite service is expected to increase even if this major user has reached a plateau. The boost for satellite service will come from growth in point-to-point, high speed voice/data communication.

The cost of launching satellites is expected to decrease by one-third now that the Space Shuttle is in service. Not only will the cost decrease but larger and heavier satellites can be handled by the shuttle. The shuttle capacity into low-earth orbit is estimated at about 30,000 kilograms. The U.S. space shuttle will face competition from other commercial launch vehicles. The European Space Agency has produced the Ariane. The Ariane is designed to

provide tailored satellite launch service into geostationary orbit. In June 1983 the Ariane successfully launched two communication satellites into earth orbit. Current plans call for six launches in 1984.

On 16 June 1982 the FCC approved direct broadcasting from satellites to homeowners' rooftops. Direct Broadcast Satellites (DBS) enable homeowners with microwave dishes on their roofs to receive programs broadcast via satellites. With the recent introduction of small receiving rooftop dishes, about 2 1/2 feet in diameter and costing between $100 and $200, a new market is expected to develop. This potential market could bring high quality transmission to rural as well as urban areas. The FCC has received applications from CBS, RCA, Western Union and others to provide this service and if approved these companies expect to be transmitting by 1985.

The deregulation of the United States telecommunication market is providing opportunities for European carriers to enter the satellite communication arena. In addition U.S. companies are planning to launch satellites over the Atlantic to compete with existing transatlantic cables. To avoid the restrictions imposed by regulatory agencies in other nations, the companies plan to sell, lease or rent the transponders, on the satellite, to other users. In this way large companies can establish their own long haul communication system and bypass the commercial carriers.

Plans such as these are causing problems for the FCC. Private companies like Orion Satellite Corporation are not common carriers. They do not technically violate the Intelsat agreement signed by the U.S. and 105 other countries. That agreement gives Intelsat a monopoly on international satellite traffic. The major concern of the FCC is that granting licenses, to these new entrants, may violate the spirit of the original Intelsat agreement and spur a worldwide race to bypass common carriers. On 1 October 1983 Intelsat launched its first business satellite in an effort to preempt the potential satellite competition. Instead of routing messages to the nearest Intelsat earth station via AT&T, Western Union or other carriers, customers can now install their own antennas and beam messages directly to an Intelsat satellite [Ref. 6: p. 144].

V. STRATEGY FOR TELECOMMUNICATION MANAGERS

A. STRATEGIC CHOICES

The telecommunication manager is presented with several major challenges today. First, to provide the best service and equipment possible, which satisfy user needs, at the least cost. Second, while deregulation of the industry presents many opportunities and pitfalls today's telecommunication managers must increase their personal knowledge of communications to create conditions advantageous to one's own users. In addition the manager must be cognizant of regulatory trends. The rulings and decisions of the FCC are subject to bureaucratic and political influence. Therefore such influence should be noted along with economic and technical considerations. Third, the sudden increase in service and equipment is creating a problem of too many choices and that may present the user a dilemma as serious as the historical lack of options available only a decade ago. It will be necessary for the telecommunication manager to educate and train users in an effort to maximize the productivity potential of this new technology and eliminate confusion and apprehension that may be present in the minds of some users.

Creating conditions which are advantageous to the users, within the telecommunication managers span of influence,

requires that the telecommunication manager possess a working knowledge of the industry boundaries and the availability of substitute products. The telecommunication industry provides for electronic, point-to-point communications needs among groups of people or machines. In addition, the largest portion of the industry output is voice telephone service. The investment in satellite channel capacity for example, was aimed primarily at the users of high speed voice, data and video communications. However the relatively high cost of service has put off all but the largest corporations. If channel capacity does not increase to the levels originally forecast, by satellite operators,, it is likely they will pursue a change in strategy. Such a shift in strategy is based on the fact that 80% of all business communications is still voice only, while 20% is data [Ref. 14: p. T23]. In an industry where the actions of buyers, competitors, suppliers and regulators are interrelated specific knowledge of developing excess channel capacity among suppliers takes on strategic importance for each group within the industry.

All firms in an industry are competing, in a broad sense, with industries producing substitute products. Telecommunications is a part of a broader communications industry, which includes the postal service, express freight carriers, and portions of the transportation industry. Telecommunications may also be viewed as a part of the broader information-processing industry. Substitutes

provide an alternative to accomplishing the same task. Increasing the number of acceptable substitutes is advantageous to the user of telecommunications because substitutes limit the potential returns to suppliers, such as the telephone companies, and place a ceiling on the prices those companies can charge. When many substitutes are available prices for products and services tend to be stable.

Identifying substitute products is a matter of searching for other products that can perform the same functions. For the telecommunication manager such substitutes may include picture phone teleconferencing instead of travel, electronic mail versus the more expensive overnight express carriers or obtaining flat rate local service instead of the industry trend of metered service. Metered service requires some cost per telephone call.

The influence of the FCC on items such as the access charge (discussed in Chapter III) is of major importance to telecommunication managers whenever a major change in service or equipment is under consideration. Although the FCC's decisions are usually justified in technical and economic terms, even when political influences have been important, predicting the course of likely action is not a simple task.

The FCC is composed of seven members, a chairman and six other commissioners. They are nominated by the President

and confirmed by the Senate. They serve seven-year terms, staggered so one commissioner is replaced each year. The chairman is appointed by the President. The commissioners rule by delegated authority and may be overruled by statute. The seven members of the FCC make decisions with the assistance of a staff of several thousand persons who are organized into bureaus and offices. The task of forecasting the course of future FCC action is complicated by the large staff available to the FCC members, substantial budget resources, politically sensitive issues which are of concern to the President and Congress and the numerous staff projects routinely in process within the bureaus and offices.

The effects of deregulation are not evenly distributed among the service and equipment markets. At present and for the foreseeable future only the telephone equipment market is fully competitive and totally deregulated. Telecommunication managers are provided the opportunity to choose among scores of different telephones produced by foreign and domestic suppliers. As a result of competition variety has increased and price has decreased.

Competition in the long distance market is different. Interstate long-distance rates are still regulated by the FCC. Within the long-distance market competitors are competing with AT&T for customers. Most of AT&T's competitors in long-distance service have flourished by using disparities among AT&T's regulated rates. The FCC is

fostering the rate disparities at AT&T's expense in order to attract new entrants into the market and reduce AT&T's market share. At some future time the FCC will certainly narrow the gap between the rates for long-distance service. Until that time the cost advantage offered by companies such as MCI and Sprint should be considered by users of long distance service. To some extent, customers who use other than AT&T long-distance service are being subsidized by those who don't.

The intrastate long distance user will also be subject to uneven competition. Prices for intrastate long distance calls may be lowered by the Bell operating company serving a region. Reductions in intrastate long distance charges may be greatly outweighed by price increases in non-competitive areas such as local service. AT&T, the seven new operating companies and other firms will vie for business where phone lines are in heavy use, and neglect areas where they are not.

Public state utility commission will regulate service rates within their state. Many local companies are asking for intrastate access charges on top of the interstate fees. The higher monthly rates sought by local companies are intended to offset revenues lost in the intrastate market to AT&T and other competitors. Will unequal competition result in unequal service? This is a concern to many public utility commissions. Telephone companies are expected to

concentrate on the revenue producing urban areas because they will lack resources and economic motivation to keep up service in noncompetitive areas.

Given the new structure in the telecommunication industry, managers are likely to be faced with classic expansion problems such as outdated plant facilities, lack of capital and bureaucratic inefficiencies. As new requirements surface they will be accommodated by the acquisition and installation of third and fourth generation telecommunication equipment. The challenge posed, centers around effective management of highly advanced services operated side-by-side or in conjunction with archaic 1920's equipment.

Although telecommunication managers view the facilities under their control as a single system, certain phases of maintenance, servicing and user training will require the participation of several suppliers and equipment marketers. The successful anticipation, planning and implementation of cost effective maintenance, service and training contracts will become an increasingly important part of telecommunication managing.

A straight forward example of the changing structure of the telecommunication industry is the home telephone bill. It is fair to say that most home owners consider the telephone as the sole two way communication system in their home. However, as of 1 January 1984, the companies

providing telephone services and leased equipment have different names, and in fact, are separate companies. For customers of Pacific Bell, which serves California and Nevada, three companies will have sections in the telephone bill which provide a breakdown of individual charges. One part lists current Pacific Bell charges for local calls placed within the service area. A second part contains charges for AT&T leased equipment. The third part lists charges for long distance service provided by AT&T Communications. Pacific Bell has arranged to do the long distance billing for AT&T and has offered a similar arrangement to other long distance companies. Maintaining the home telephone presents similar problems. If a problem with telephone service develops Pacific Bell would assist in determining the source. If the problem is located within Pacific Bell's lines or equipment they would repair it at no cost. However if the problem is within the home, responsibility for restoring service is vested with the home owner. The cost of repair and to the time value of locating companies who handle those repairs, is separate from the monthly telephone service cost.

Strategic planning and careful consideration of service and equipment are important to daily efficient operation of a telecommunication system. When the system is working correctly the service it provides is taken for granted. In the past when the system experienced a breakdown the Bell

repairman was called and service was restored quickly, in most cases. In the present deregulated environment high quality day-to-day service is also likely to continue. But what will happen in the case of an emergency?

Recent history provides many examples of cooperation among the Bell operating companies and AT&T. For example, in 1974 a major fire destroyed central office equipment in New York City. Western Electric rerouted similar equipment destined for another customer. Personnel came in from many parts of the country and service was restored to over 100,000 customers in a very short period of time [Ref. 22: p. 4]. This same level of cooperation is not available today. This may well be one of the more significant impacts of divestiture.

The telecommunication manager must make equipment and service choices based on its ability to meet user requirements. In addition it is also necessary to consider repair and replacement factors in case of an emergency. Equipment manufactured and purchased from new firms may be difficult to obtain several years later. Logical distribution channels for the product may find it unprofitable to continue selling some equipment. If these are real possibilities the telecommunication manager must consider conversion costs during the initial planning and purchase. Switching costs are one time costs facing a buyer when changing form one supplier's product to another.

Switching costs may include employee retraining, costs of new ancillary equipment, cost and time in testing or qualifying a new source, need for technical help as a result of reliance on seller engineering aid or product redesign [Ref. 23: p. 10].

Finally, all telecommunication managers must cope with the uncertainty and risk present in the telecommunication industry during this period of development. There will be consolidations, mergers and bankruptcies as the rules of this new competitive environment become defined. Government policy must be considered. It is always possible for the FCC to limit or even close entry to certain markets by imposing controls such as licensing requirements and rate structuring. Yet all these factors have another side. The emerging phase of an industry's development is probably the period when the strategic degrees of freedom are the greatest and when leverage from good strategic choices is the highest in determining performance.

B. ADVANTAGE OF CHANGE

The structural change in the telecommunication industry, brought about by government fiat, has been welcomed by most suppliers and buyers. Each expects to benefit. Suppliers are concentrating on building market share in an industry recently emancipated from government controls. Consumers expect benefits ranging from products offering performance

advantages unachievable before to items that offer solely a cost advantage.

From a managers perspective the incentive to buy new products or service, other things being equal, is based on improved performance. Cost is considered but the erratic performance of new firms is viewed with uncertainty. Whether the advantage from new products or service is one of cost or performance the final decision to buy a product depends on other supporting advantages. Does the performance advantage improve productivity? How large is the cost advantage? What is the reliability of the equipment? Are spare parts, maintenance and service available?

The advantages made possible by deregulation require telecommunication managers to review their systems. The purpose of a system review is to identify areas in which cost or performance advantages exist. Some of the following service and equipment areas are candidates for review.

1. Long distance service provided by specialized common carriers.
2. Purchase or lease of equipment which sends calls by minimum-cost routes.
3. PBX systems, key telephone sets and individual telephones can be leased, rented or purchased.
4. Identifying an optimum mix of leased lines, WATS lines, microwave or satellite channels.
5. Selecting a mix of electronic and express mail service.
6. Use of teleconferencing versus travel.

7. Purchase versus lease of telecommunication equipment.

8. Construction and operation of a private communication system.

The advantages of change are not without problems. New products or service often replace existing products or services. Retraining cost can be substantial. Support services such as engineering service, set up and testing times are an added expense. The cost of replacing equipment before it is worn out can result in undepreciated investment charges. While most telecommunication user equipment is designed for ease of operation some equipment may have long learning curves.

C. REDUCING RISK

Telecommunication managers will not be able to escape the impact of the AT&T breakup. The rate of the change will depend on the industry developments and direction as well as the managers requirements for increased or new products and services. As an industry undergoes fundamental change it creates uncertainty among decision makers. The risk involved in utilizing new products and services are not confined only to the telecommunication managers. Other industry participants such as buyers, suppliers, potential entrants and substitute products and services also experience apprehension during an industry transition. The resulting dilemma of future uncertainty coupled with the certainty of change are significant obstacles when

formulating strategy. Strategy cannot be formulated without an explicit or implicit forecast of how the structure of the industry will evolve. The number of variables that enter into a forecast can be sizeable. As a result it is necessary to find methods of reducing the complexity of the forecasting process.

One tool used to simplify forecasting, when faced with many uncertainties, is the scenario. Scenarios are discrete, internally consistent views of how an industry will look in the future, when bounded by a probable range of outcomes that might feasibly occur [Ref. 23: p. 234]. The basis for building a scenario begins with an estimate of the future evolution of equipment and service, in such terms as cost, usage, demand and performance. The manager should select a small number of internally consistent equipment and service schemes that encompass a range of possible outcomes. For example, long distance service considerations could include leased service from AT&T, private line service from specialized common carriers, WATS line service or constructing a private long distance microwave system. For each of these specific scenarios it is necessary to postulate the effects of deregulation. How much competition exists or is likely to enter? Is the service available likely to increase or decrease? What is the size and characteristic of the long distance market? At this point in the scenario it is necessary to provide a feedback loop.

The feedback loop permits opportunities to modify the scenario due to the changing nature of technology and industry competition.

The next step is to associate the various long distance service scenarios with the existing competitive market environment. Each competitor could then be ranked according to a prioritized selection criteria. For example, selection of a specific scenario could be based on factors such as availability, quality, service, maintenance or reliability. For some telecommunication needs such as video phone service this sequence of events may well involve forecasting the entry of new firms in order to compensate for the limited number of existing suppliers. This would involve a second feedback loop, because new entrants can influence the direction an industry takes in its development.

Having developed the scenarios as outlined, a manager can objectively review its options, and assess which service will best meet its needs. In addition, by using a systematic approach to forecasting a format will be developed for strategic planning and reducing risk.

The systematic approach to forecasting is not needed in every decision affecting telecommunication service and equipment. Given the present state of the industry, managers can take several obvious steps to reduce risk. First, obtain flat rate local service. Rates for metered service, which means paying a charge for each call, have

been supported by many state regulatory commissions. Present users with flat rate service may be grand-fathered if there is a rate change. Second, the AT&T telephone will become a better buy in the second half of 1984. After 1 January AT&T no longer owns the local telephone company. The local company will lack both the authority and motive to cut off service if payment isn't made to a third party such as AT&T [Ref. 24: p. 84]. AT&T recognizes this unfavorable situation and is expected to initiate sizable reductions in the sale price of leased telephones. It is also placing additional pressure on the profit margins of competitors in the telephone sales market. Third, purchase telephone equipment without expensive extras. However some useful options deserve consideration. Such as redial and number storage capabilities. During this period of industry transition paying for telephone extras, intended for future use, is risky because technology and time can bypass and make obsolete such investments.

D. HIDDEN COSTS

Consideration of hidden costs take on added importance during this period of transition in the telecommunication industry. With the proliferation of new products and services managers should view with caution innovations which seem too good to be true. New entrants into the industry will face limits or problems of varying severity. Their

ability to respond to customer needs may be limited by economic factors or the lack of technological know-how.

Managers will be deluged by many products and services, technological variations and conflicting claims and counterclaims by common carriers and equipment makers. This is all symptomatic of technological uncertainty and the resulting lack of standardization by industry participants.

Cost and performance factors alone will not reveal the true advantages or disadvantages of a system. The quality of service or equipment should be examined before making significant investments. Erratic quality and poor performance can often be traced to a lack of standards. In some instances poor service quality can be the result of infighting among industry competitors.

AT&T's long distance competitors, such as MCI and Sprint are notorious for poor service. Customers of the discounters frequently encounter delays in completing calls and are plagued by bad connections. These cannot be simply rectified by dialing O--the long distance companies have no operators. Competitors blame this inferior service on the fact that when the courts forced AT&T to allow competitors access to local telephone lines it gave them poor quality connections [Ref. 24: p. 82]. AT&T countered charges of giving poor quality circuits to competitors by offering better quality connections, but at a higher price.

Another hidden cost may involve delays in licensing by state utility commissions or changes in policy by the FCC. The regulatory bodies have shown the will and capacity to take on the industry leaders and win. Government policy has created market share for service and equipment makers and placed competitors in the technological spotlight almost overnight.

AT&T and the Bell operating companies have the most to lose from deregulation. They are threatened industries. To date they have not responded to the challenges from competitors in a meaningful way. This is partly due to their preoccupation with divestiture and internal efforts to reorganize. It would be a mistake and a hidden cost for the telecommunication manager to neglect the inevitable counterattack that will be launched by these industry giants.

The industry leaders can fight the emerging firms in a number of ways. One is in the regulatory arena. AT&T and the Bell operating companies have no peers in this arena. Regulatory experience reaches back decades. A second way involves foregoing profits by lowering prices. This tactic would force other firms to match the price cut or lose market share. At the present time the FCC has put a regulatory roadblock in the path of AT&T that effectively prevents AT&T from lowering prices for long distance service. However, Western Electric is not prevented from

lowering prices to increase its share of the telecommunication market. Furthermore the R&D capabilities of the Bell Laboratories can be focused to bring in stream a plethora of new commercial products.

The opportunity to select among a variety of suppliers introduces the specter of another hidden cost. If the telecommunication facility suffers a massive outage in communication circuits the ability to restore circuit operation is complicated by the topography of each circuit and the points of contact at various telephone companies. Gone are the one-step procedures. No longer will it be possible to call a Bell system trouble office and await the return of service. It will now be necessary to put in place effective emergency plans, train operators and technicians and exercise those plans to insure they are functional.

The hidden costs in available service and equipment are real issues that must be considered in the strategy of telecommunication managers. Those hidden costs are elusive and easily forgotten. However they are most likely to surface when system outages or equipment failures occur. The challenge then is to locate the weaknesses and take preventative measures before failures in equipment and service develop.

E. STRATEGIC PITFALLS

Until the telecommunication industry matures and adjusts, to the effects of divestiture, deregulation and competition, the basic structure of the industry will be subject to change. The changes in the industry structure will be reflected in areas such as the intensity of competition, the number of new entrants and the overall mobility barriers. Mobility barriers such as proprietary technology, access to distribution channels, learning curves and risk have a tendency to decline in importance as the industry matures. It is necessary for managers to preplan strategic responses because unanticipated structural changes could result in long term investments, in service and equipment, that have become obsolete earlier than expected.

Industries often rotate leadership. They go through boom and bust periods. During the boom periods growth and change may be propelled by a change in national priorities, regulatory change, technological developments or similar factors. Growth industries often receive increased resources from the available budgets. The media devotes substantial time and effort to report new developments or promising products. Enthusiasm among the industry and general population is often very great. Improvements in productivity and efficiency are expected to result. Strategic errors among the emerging firms that provide

service and equipment are often masked by the rapid growth of the industry.

The telecommunication industry is currently experiencing such a boom. At some future time the boom will end and it is a significant managerial error to ignore the realities of history. All industries mature at different rates therefore the duration cannot be predicted.

Managers can implement procedures which provide protection for themselves and their users as the industry matures. First, using benefit to cost evaluation techniques will aid in identifying a rational mix of equipment and service. Although utilizing a variety of equipment and service may be possible during the industry growth period, this situation may no longer be viable as the industry matures. Second, budget constraints will be imposed as priorities change and the telecommunication manager may be faced with the task of pruning unproductive equipment and inefficient service from the facility. It will not be possible to lump the entire facility output together. Equipment and service will be judged individually on its merit and contribution to productivity.

Another hazard to be avoided is the use of long term contracts for equipment and service. Securing adequate sources of repair parts, maintenance, and support service are necessary to the successful operation of a facility. However entering into such agreements too early in an

industries development can be expensive. For example, budget cuts may force a manager to give up some service or equipment. While it is possible to end contracted services termination clauses can be a costly price to pay for a decision made in haste. Similarly advancements in technology are occurring so quickly that services or equipment may become obsolete before the end of a contract's life.

The points raised so far have focused on enhancing the appreciation of financial considerations along with underlying theme of quality. Commensurate with financial considerations are deliberate efforts to raise the level and training of telecommunication managers. The complexities brought about by the structural changes in the industry have increased the demands placed on managers. The tasks of operating current facilities and planning for facility changes are more pressing than ever. Top management is drawn by the productivity improvements and competitive advantages offered by the changing technology. They look to the telecommunication manager for advice and recommendations on issues concerning service and equipment. The degree of credibility is directly related to the technical expertise possessed by the manager and ones ability to communicate that expertise in an effective administrative manner. Neglecting the training of telecommunication managers is a strategic pitfall to be avoided.

As a result of inadequate training or poor technical skills the telecommunication manager may fail to recognize the opportunities presented by an industry in transition. Equipment and service would continue at the historical level and correcting such a situation, therefore, would require more involvement of top management.

VI. SUMMARY AND CONCLUSION

A. SUMMARY

This thesis has reported on the transition of the telecommunication industry and the impact on that industry resulting from AT&T's divestiture. The impact of the structural changes underway are still unfolding. The future administration of voice and data have been fundamentally altered. History has shown that relations between AT&T and the FCC have ebbed and flowed. First in favor of the regulated monopoly concept but more recently issuing decisions in favor of telecommunication industry competition. The actions of the Department of Justice have consistently been directed toward reducing AT&T's hold on the telecommunication industry. Through a protracted series of anti-trust suits and consent agreements the monopoly position once held by AT&T has been broken. Sequential developments in both the regulatory and competitive arenas have been reviewed. Telecommunication developments have been examined in order to illustrate first, the dynamic changes in the industry and second, the direction in which technology is evolving. Finally, the management considerations were addressed. The responsibility for the operational effectiveness of telecommunication facilities rests with the decisions made by those managers charged with

the task of providing equipment and service. As the industry moves from transition to maturity managers will have a need to implement changes, anticipate opportunities and avoid pitfalls. Therefore, the managerial section addressed possible strategies, tactics and options available.

The process of change is driven by regulatory fiat, legal action taken by the Department of Justice and new entrants to the telecommunication market. All seemingly are of a single purpose, which is, to provide equipment and service to a nation confronted by growing demand for telecommunications . Meeting that demand will necessitate a high degree of flexibility with regard to planning and products. The service previously provided by AT&T was unsurpassed. The future service promises to be even better, more diversified and competitive. What remains to be seen is if the structural changes and promising technology can be harnassed by a diverse group of competitors to provide continued excellent service.

The changing role of the telecommunication manager, as detailed in this thesis, requires a greater degree of involvement in managing the facility than at any time in the past. The manager must recognize the user needs and take the appropriate action to obtain them. Cost and performance factors must be balanced with other considerations such as the direction of technology, regulatory environment and

obsolescence. It will be necessary to have a working knowledge of the recent events that have shaped the telecommunication industry. The industry trends are rooted in the actions taken by the FCC and the Department of Justice. Without understanding the basis for those actions a manager could fail to recognize new opportunities.

The need for technical competence among managers is another aspect of a changing telecommunication environment. The decisions for equipment and service will now be made without the assistance of AT&T. The single point of contact for equipment and service is gone forever. The lack of technical competence will have direct financial ramifications and long term effects on system performance. It is necessary to know the technical performance characteristics of equipment and be able to match those to user requirements.

In order to communicate the technical requirements to top management the telecommunication manager must be knowledgeable about other areas of administration. Therefore, management strategies were examined. The use of managerial strategies is an effective way to maximize cost and performance opportunities which will develop as the industry proceeds through its current transition. Recognizing trends early permits top management a certain degree of flexibility. In an industry where technology changes rapidly, costs can be reduced by defensive and

offensive moves. However to take prompt action in one direction or another requires prior planning, managerial leadership and technical competence. The changing role of the telecommunication manager requires skills in each of these areas. If properly applied the resulting benefits could include raised productivity and a balanced mix of equipment and service.

The complex industry environment and the speed with which it has come about is without precedent. The day-to-day management of facilities is resulting in problems today which did not exist a few years ago. To resolve those management problem firms that specialize in telecommunication management have been formed. The use of consultants was reviewed in this thesis. Large users with complex facilities, such as the Defense Communication Agency are currently examining the option of contracting out their facilities.

Similarly the use of consultants may be practical in local situations where special circuits between states or within states will be subject to regulation by more than one public utility commission. Consultants can be useful in the field of telecommunication law. They could perform as advocated to resolve special requirements as may be imposed or proposed from time to time by regulatory agencies, county governments or cities. In any event the telecommunication manager will have to be aware of the regulating agencies

that govern equipment and service. The use of consultants may simplify that task.

At the present time circuit quality of both voice and data are good. At issue however is whether it will remain so. Competitive pressure and economic disincentives may result in reduced quality for some users. Urban centers and large users of telecommunications are expected to receive the most attention from competitors. Rural users and low density circuits are not expected to fare as well. As more information is passed in digital form the issue of circuit quality becomes important to managers. If circuit quality does decrease the message error rate would rise and additional time would be required for retransmissions. Many of the quality problems should be resolved as the industry matures and agreements are reached on technical standards.

The issue that will affect the most users is, of course, the access charge. The FCC has postponed the charge for home telephones and small businesses. But what of the future? Without AT&T to subsidize the local telephone companies their revenue base will erode, and service may follow soon after. The local telephone companies will lobby intensely for this revenue source. If it is set too high many home users may drop the service. Although the companies indicate they will offer life line service at a price affordable to everyone it is, after all, not in their interest to drive down the number of telephone users. On

the other hand those corporations of means may well decide to bypass the local networks by building private communication systems. It is reasonable to assume that access charges will be a fact of life. The questions to be resolved by the regulatory agencies is the amount and the time.

B. CONCLUSION

The changes in the telecommunications industry are not all history. They are ongoing and accelerating. The industry is in transition and is intertwined with other industries. The growth and change will continue. Developments in voice and data technology promise to reduce telecommunication cost below today's level. The cost of energy is high and future increases will only sharpen the demand for telecommunication service. Substitutes like the postal service and air express will lose customers to technological advances like electronic mail. The need to communicate in an industrialized economy is great and future economic growth will require more telecommunication services. The trend in public policy is clear. Potential entrants are encouraged and market share has been provided by regulatory fiat. The opportunities in the telecommunication market are so great that no one company could use them all. To obtain the maximum benefits from this industry it will be necessary to allow wide participation, with the

opportunity for many companies to provide innovative equipment and service. The success or failure or such innovations, will be measured by the ability to meet the telecommunication needs of the nation.

APPENDIX A

TELECOMMUNICATION DEVELOPMENTS AND USES

1. Telephone Enhancements

   Dial-up services
   Teleconferencing
   Telephone answering devices
   Call Forwarding
   Telemedical service
   Public opinion polls
   Weather reports
   Sports information
   Banking

2. Networking

   Electronic mail
   Data processing
   Information retrieval
   Shopping
   Transportation schedules
   Travel advice, Restaurant guides
   Subscriber programming
   Electronic billboards
   Educational programs
   Advertising
   Real estate service
   Employment service
   Directory assistance
   Yellow pages

3. Video Communication

   Videoconferencing
   Picturephone
   Catalogue displays
   Shopping
   Weather
   Literature reviews
   Entertainment
   Security systems
   Banking
   Videotex
   Stock market service
   Electronic mail

Newspaper/magazine service
Information retrieval
Television
Educational programs

4. Satellite Communication

Radio
Television
Data
Private communication systems
Business system
Facsimile
Teletex
Real time remote broadcast
Weather
Emergency location service
Navigation
Electronic mail, newspaper, magazine
Voice service
Data service
Direct broadcast service

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